



STATE OF RHODE ISLAND
**ENERGY EFFICIENCY &
RESOURCE MANAGEMENT COUNCIL**

CONSULTANT TEAM

national**grid**

Evaluation, Measurement and Verification (EM&V) Update

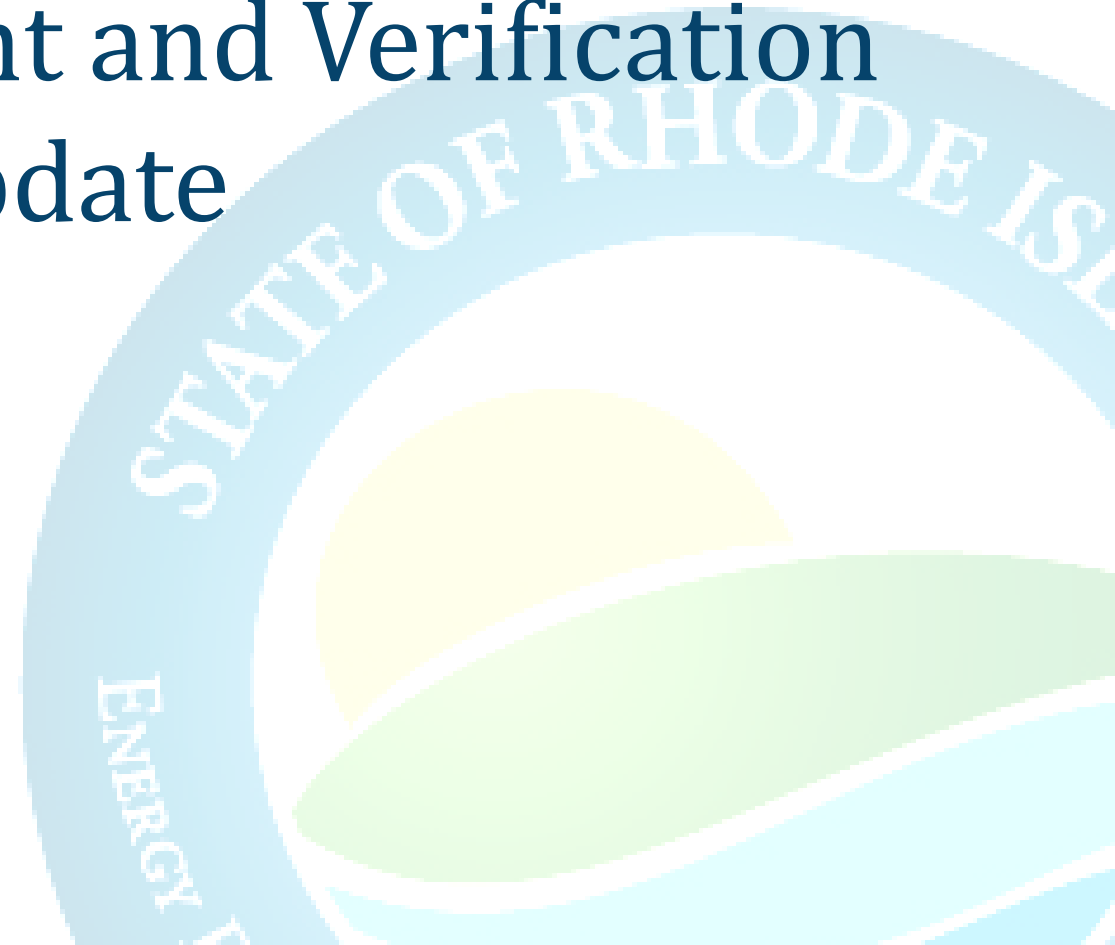
Presented to the EERMC By:

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Rhode Island EM&V Standards

This **Measurement and Verification (M&V) Plan** shall address:

- Savings verification, including where appropriate analysis of customer usage.
- Verification should also facilitate participation in ISO-NE's forward capacity market;
- Issues of ongoing program design and effectiveness;
- Efforts related to market assessment and methodologies to claim savings from market effects, among others;
- Regional and other cooperative EM&V efforts the distribution company is participating in, or plans to participate in; and
- Longer-term studies, as appropriate, to assess programs over time.



EM&V Team

Rhode Island Evaluation Team

nationalgrid

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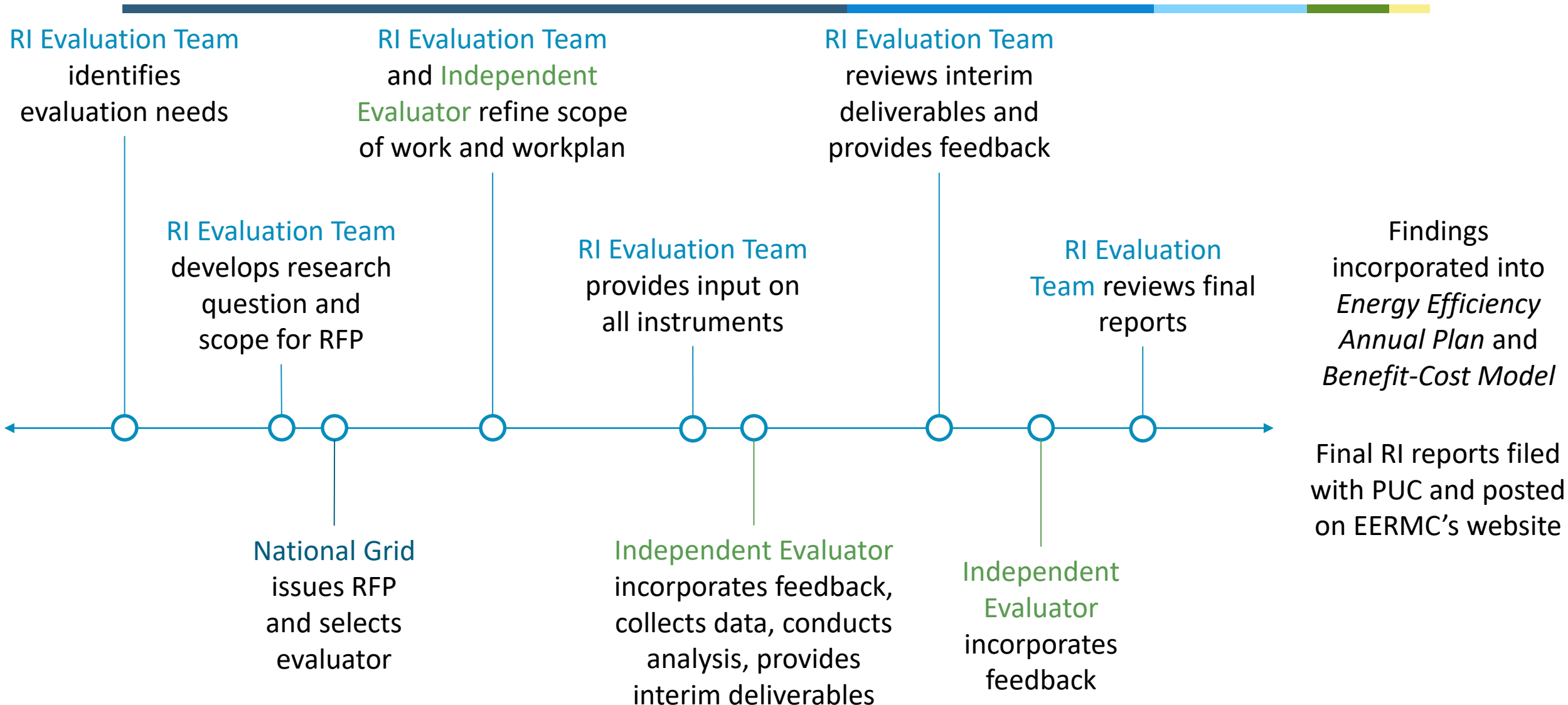
EM&V Oversight

RI Evaluation Team
meets twice per month to
review the status and
updates associated with all
identified EM&V studies

Sector	Programs	Study names	Fuel(s)	Type	State	Status (In-progress or Complete)	Will be completed in time for 2021 Plan? (Y/N/TBD)	Adopting Impact Factor in 3YP?	Adopting Results in 3YP?	Monthly Update	Call	NGRD Comments	Clean Comments
Residential Program Studies													
Res	Multiple	RI-19-RE-HEM- Residential Home Energy Monitoring (Sense) Demonstration	Elec	Impact/Process	RI	In-progress	N	N	N	Y	Res	7/21: Revising non-participant survey guide	
Res	EWSF	RI-20-RX-EWSFImpact - Impact Evaluation of EnergyWise Single Family Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft results memo expected this week	
Res	EWSF	RI-20-RX-EWSFProcess - Process Evaluation of EnergyWise Single Family Program	Elec/Gas	Process	RI	In-progress	Y	N	N	Y	Res	7/21: Finalizing analysis and drafting report	
Res	EWMF	RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft results memo expected this week	
Res	EWMF	RI-20-RX-EWMFProcess - Process Evaluation of EnergyWise Multifamily Program	Elec/Gas	Process	RI	In-progress	Y	N	N	Y	Res	7/21: Finalizing analysis and drafting report	
Res	IEMF	RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft results memo expected this week	
Res	IEMF	RI-20-RX-IEMFProcess - Process Evaluation of Income Eligible Multifamily Program	Elec/Gas	Process	RI	In-progress	Y	N	N	Y	Res	7/21: Finalizing analysis and drafting report	
Res	Behavior	RI-20-RX-HERImpact - Impact Evaluation of the Home Energy Reports Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft report is out for review. Comments due Aug 3rd.	
Res	Res Lighting	RI-20-RE-UpstLight - Residential Lighting Market Assessment - Shelf Stocking	Elec	Market	RI	In-progress	Y	N	Y	Y	Res	7/21: Revising report to address 2nd round of comments.	
Res	Res Lighting	RI-20-RE-UpstLight - Residential Lighting Market Assessment - Sales Data Analysis	Elec	Market	RI	In-progress	Y	N	N	Y	Res	7/21: Analysis in progress	
Res	Res Lighting	Lighting Supplier Interviews	Elec	Process	MA	In-progress	Y	N	N	Y	Res	5/26: Draft report.	
Res	Res Lighting	MA19R15-E 2019 Residential Lighting On-sites	Elec	Market	MA	In-progress	Y	N	N	Y	Res	Analysis underway	Reporting
Res	Res Lighting	MA20R22-E LtgSalesDataAnalysis	Elec	Market	MA	In-progress	Y	N	N	Y	Res	Regional study - Includes RI data (see RI-20-RE-UpstLight - Residential Lighting Market Assessment - Sales Data Analysis)	
Res	Res Lighting	Lighting Turn In Study	Elec	Impact	MA	Completed	Y	N	N	N	Res	Final report	
Res	Res Lighting	Lighting Hours of Use Study	Elec	Impact	MA	Completed	Y	Y	Y	N	Res	Final report delivered 04/01	
Res	Res Lighting	MA19R09-E Onw LED Delta Watt Update	Elec	Impact	MA	Completed	Y	Y	Y	N	Res	Final report	
Res	Res Lighting	18-8 Market Scan	Elec	Market	MA	Completed	Y	N	N	N	Res	Draft report.	
Res	RNC	RNC MF Baseline	Elec/Gas	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	RNC	RNC Non-Program Model Review (MA19R19-B-RNCNP)	Elec/Gas	Process	MA	In-progress	N	N	N	TBD	Res		
Res	RNC	RNC Energy Optimization Cost Study (MA20R23-RNCECOST)	Elec	Cost	MA	In-progress	N	N	N	TBD	Res		
Res	RNC	Renovations and Additions Market Characterization and Potential Savings Study (RLPNC 18-12)	Elec	Market	MA	Completed	Y	N	N	N	Res		
Res	RNC	RNC Passive House Design Assessment	Elec/Gas	Process	MA	Completed	Y	N	N	N	Res	Not transferable	
Res	HES	HES Realization Rate Assessment	Elec/Gas	Impact	MA	Completed	Y	N	N	N	Res	Final report 3/23	
Res	Multifamily	Multifamily M&HP Assessment Study	Elec	Impact/Process	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	2019-20 Winter Thermostat Optimization (MA20R20-B-WTO)	Elec/Gas	Impact	MA	In-progress	N	N	N	TBD	Res		
Res	HVAC	2019 Residential Summer Thermostat	Elec	Impact	MA	Completed	Y	N	N	N	Res		
Res	HVAC	Winter Thermostat Optimization (MA19R03-B-WTO)	Elec	Impact	MA	Completed	Y	N	N	N	Res		
Res	HVAC	Energy Optimization Process and Impact Study (MA20R24-E-EOP)	Elec	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	Programmable Tstat Impact	Elec	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	ECM Pumps	Elec	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	Residential Energy Optimization Model Update (including Heat Pump Online Calculator	Elec	Impact	MA	Completed	TBD	TBD	TBD	N	Res	Study is complete with exception of online calculator.	
Res	DR	Residential Wi-Fi Thermostat DR Evaluation (MA19R01-E-RESORTSTAT)	Elec	Impact	MA	Completed	Y	Y	Y	N	Res	Study is complete	
Res	DR	2019/2020 Residential Energy Storage Demonstration (MA19R02-E-DRBS)	Elec	Impact	MA	In-progress	Y	Y	Y	N	Res		
Res	Multiple	RCV Virtual Assessment Study	Elec/Gas	Process	MA	Upcoming	N	N	N	TBD	Res		
Res	Multiple	Smart Thermostat Impact Study (RES 24)	Elec/Gas	Impact	MA	In-progress	N	N	N	Y	Res	Expected completion 12/20	Implemented in multiple stages
Res	Multiple	Baseline Study Phase 4 - Smart Tstat and Gas Metering Add-ons	Elec/Gas	Impact	MA	In-progress	TBD	TBD	TBD	Y	Res	Reporting	
Res	Multiple	MA19R17-B-TRM Comprehensive TRM Review	Elec/Gas	Impact	MA	In-progress	Y	Y	Y	N	Res	Reporting	Final draft report available
Res	Multiple	Non-Participant Research	Elec/Gas	Market	MA	Completed	Y	N	TBD	N	Res	Final Report delivered 2/27	
Commercial & Industrial Studies													
C&I	C&I Gas	RI-19-CG-CustGas - Impact Evaluation of PY2017 Custom Gas Installations	Gas	Impact	RI	In-progress	Y	Y	Y	Y	C&I	8/4: One-page summary provided by DNV 7/31 for review	
C&I	C&I Gas	RI-20-CG-CustGasPY19 - Impact Evaluation of PY2019 Custom Gas Installations	Gas	Impact	RI	In-progress	Y	Y	Y	Y	C&I	8/4: Expect MBV to be completed for 6 of 8 sites for first draft. Will incorporate DRs for other two sites by applying results from 6 sites to missing factors from DR	
C&I	C&I Gas	RI-20-CG-CustGasPY19 - Impact Evaluation of PY2019 Custom Gas Installations	Gas	Impact	RI	In-progress	N	N	N	N	C&I	8/4: Final 2019 year end data for sample design sent to DNV-GL. DNV GL working on sample design for desk reviews. Metering to start in the fall w/ colder weather.	
C&I	C&I Elec	RI-19-CE-CustElec - Impact Evaluation of PY2018 Custom Electric Installations	Elec	Impact	RI	In-progress	Y	Y	Y	Y	C&I	8/4: Finalizing DRs. Will use desk reviews of 2018 to inform 3YP and Annual Plan	
C&I	C&I Elec	RI-20-CE-CustElecPY19 - Impact Evaluation of PY2019 Custom Electric Installations	Elec	Impact	RI	In-progress	N	N	N	N	C&I	8/4: Sample design complete. Unclear on when metering will start - will 2018 come first?	
C&I	C&I	RI-20-CX-FRSD - C&I Free-Ridership and Spillover Study	Elec/Gas	NTG	RI	In-progress	Y	N	N	Y	C&I	8/4: Survey in progress. Results due week of 9/7 with goal of informing 3YP and Annual Plan. Planning to call through 8/21. Initial scope included upstream lighting	
C&I	C&I Lighting	RI-19-CX-UpstLight - Impact Evaluation of PY20x Upstream Lighting Program	Elec	Impact	RI	Scoping	Y	Y	Y	Y	C&I	8/4: NTG added to scope, workplan and budget in progress; piggybacking with MA	
C&I	C&I	RI-19-CX-Presc - Prescriptive Gas & Electric Measures	Elec/Gas	Impact	RI	SEP	TBD	TBD	TBD	Y	C&I	8/4: Waiting for MA to determine scope	
C&I	C&I Demo	RI-20-CX-SEM - Strategic Energy Management Demonstration Evaluation	Elec/Gas	Impact/Process	RI	In-progress	Y	N	Y	Y	C&I	8/4: Draft report under review by NGRD.	
C&I	C&I Demo	RI-20-CG-SBHP Small Business Heat Pump Demonstration Evaluation	Elec	Impact/Process	RI	Upcoming	Y	Y	Y	Y	C&I	8/4: Approach to demo changed; eval not needed in 2020.	



EM&V Process



From Study to Plans

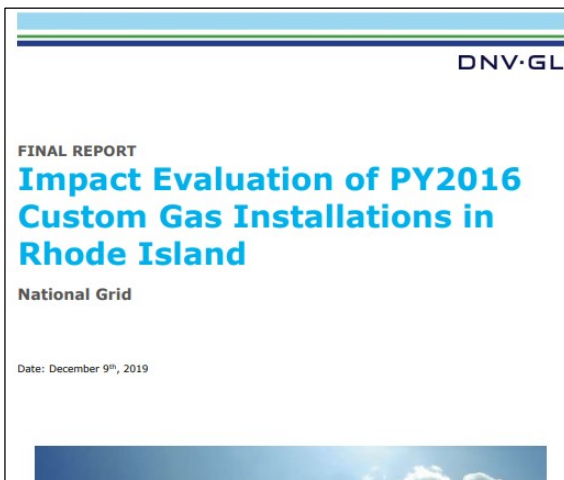


Table 1-1. PY2016 National Grid territory results in MA and RI

Results by State	MA	RI	MA+RI
Tracking Savings (therms)	5,141,434	1,114,770	6,256,204
Evaluated Savings (therms)	4,534,668	795,000	5,329,668
Realization rate	88%	71%	85%
Relative Precision 80% CI	±9%	±11%	±10%
Error bound	8%	8%	7%
Sample size	21	8	29
Error ratio	0.35	0.27	0.34



2020 RI Gas BCR Model Final Draft

Sector	Program	Measure	Quantity	Measure Life	Total Resource Cost	Incentive	Customer Cost	Free-Ridership Rate	Spillover [Participant] Rate	Spillover [Non-Participant] Rate	Net to Gross	In-Service Rate	kWh Realization Rate
C - Commercial & Industrial	Large C&I Retrofit	Custom: General	72,200	13	32.2	16.1	\$ 16	11.1%	0%	0.0%	88.9%	100.0%	85.0%

Rhode Island

Technical Reference Manual

For Estimating Savings from Energy Efficiency Measures

2020 Program Year

Process

Sector: C&I

Measure Category: Custom

Program: Large C&I Retrofit

Measure Description

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RR _{Gas}	RR _{Electric}	RR _{sp}	RR _{wp}	CF _{sp}	CF _{wp}
Process	mult	1.00	1.00	0.85					

BC Model

Benefits

Costs

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS PUBLIC UTILITIES COMMISSION

In Re: The Narragansett Electric Company
d/b/a National Grid
Annual Energy Efficiency Plan for 2020

Docket No. 4979

ANNUAL ENERGY EFFICIENCY PLAN FOR 2020

SETTLEMENT OF THE PARTIES

Table E-5
National Grid
Calculation of 2020 Program Year Cost-Effectiveness
All Dollar Values in (\$000)

	RI Test Benefit/ Cost ¹	Total Benefit	Program Implementation Expenses ²	Customer Contribution	Shareholder Incentive	c/Lifetime kWh
Non-Income Eligible Residential						
Residential New Construction	2.65	\$ 4,712.9	\$ 973.5	\$ 807.8		11.2
ENERGY STAR® HVAC	2.64	\$ 12,522.0	\$ 2,763.2	\$ 1,965.1		25.3
EnergyWise	2.23	\$ 38,682.0	\$ 15,692.2	\$ 1,659.1		77.8
EnergyWise Multifamily	2.79	\$ 9,296.8	\$ 2,484.3	\$ 532.0		11.4
Home Energy Reports	2.82	\$ 7,701.1	\$ 2,728.1	\$ -		11.7
ENERGY STAR® Lighting	6.05	\$ 62,401.2	\$ 15,375.8	\$ (5,069.1)		5.1
Residential Customer Products	2.97	\$ 9,942.9	\$ 2,199.2	\$ 1,151.4		10.5
Residential ConnectedSolutions	3.68	\$ 1,697.1	\$ 461.6	\$ -		N/A
Energy Efficiency Education Programs		\$ -	\$ 40.0			
Residential Pilots		\$ -	\$ 287.8			
Community Based Initiatives - Residential		\$ -	\$ 203.9			
Comprehensive Marketing - Residential		\$ -	\$ 282.3			
Non-Income Eligible Residential SUBTOTAL	3.12	\$ 146,956.0	\$ 43,931.9	\$ 1,046.2	\$ 2,159.1	13.3
Income Eligible Residential						
Single Family - Income Eligible Services	2.78	\$ 35,667.4	\$ 12,846.1	\$ -		31.8
Income Eligible Multifamily	2.33	\$ 8,286.5	\$ 3,540.0	\$ -		11.1
Income Eligible Residential SUBTOTAL	2.55	\$ 43,953.9	\$ 16,386.1	\$ -	\$ 819.8	22.7
Commercial & Industrial						
Large Commercial New Construction	7.00	\$ 43,816.6	\$ 5,335.7	\$ 920.2		4.2
Large Commercial Retrofit	8.01	\$ 303,474.8	\$ 23,801.3	\$ 14,063.2		4.6
Small Business Direct Install	3.75	\$ 37,514.2	\$ 7,568.6	\$ 2,439.0		7.9
Commercial ConnectedSolutions	13.01	\$ 27,031.2	\$ 2,078.5	\$ -		N/A
Commercial Pilots		\$ -	\$ 106.3			
Community Based Initiatives - C&I		\$ -	\$ 66.1			
Finance Costs		\$ -	\$ 5,216.7			
C&I SUBTOTAL	6.47	\$ 411,836.8	\$ 44,173.2	\$ 17,424.4	\$ 2,099.4	5.6
Regulatory						
OR		\$ -	\$ 893.7			
FERMC		\$ -	\$ 893.7			
Regulatory SUBTOTAL		\$ -	\$ 1,787.4			
TOTAL	4.64	\$ 602,746.7	\$ 106,291.6	\$ 18,478.6	\$ 5,078.3	8.3

Notes:
(1) RI Test BC Test = (Energy + Capacity + Resource Benefits - Economic Benefits + Carbon Benefits) / (Program Implementation + Customer Contribution + Performance Incentive)
Also includes effects of free-ridership and spillover.
(2) For Implementation Expenses derivation, see Table E-3.
(3) ENERGY STAR® Lighting customer cost is negative due to a high free-ridership rate. Any financial incentives paid to free-riders are counted as a cost because the Company incurred these costs as part of the overall cost of the Plan regardless of whether the participant is free-rider or not. Therefore the Company reduces benefits and the customer cost by the net-to-gross ratio but not the incentives.

Studies Informing 2021 Plan – C&I

Program	Study Type	About
Large C&I Gas	Impact	<p>Custom Impact Evaluation: Verify savings estimates for a sample of custom gas projects through site-specific inspection, metering, and analysis.</p> <p>Measure Life Study: Recommended update to commercial boiler measure life. (Leveraged from MA.)</p> <p><i>Plan impact: Decrease in claimable savings for gas. Custom gas realization rate decreases from 85.0% to 84.2%. Boiler measure life decreases from 25 years to 20 years.</i></p>
Large C&I Electric	Impact	<p>Verify savings estimates for a sample of custom electric projects through site-specific inspection, metering, and analysis.</p> <p><i>Plan impact: Decrease in claimable savings for lighting: realization rate decreases from 99.8% to 93.8%. Increase in claimable savings for non-lighting electric: realization rate increase from 65.5% to 71.9%.</i></p>
All C&I	Free Ridership & Spillover	<p>Determine free-ridership and spillover values based on an assessment of the behavior of participants and nonparticipants of C&I energy efficiency programs.</p> <p><i>Plan impact: TBD; results available mid-September.</i></p>

Studies Informing 2021 Plan – C&I

Program	Study Type	About
Strategic Energy Management Demo	Impact & Process	Verify savings from strategic energy management (SEM) demonstration. <i>Plan impact: No impact to claimable savings. Will inform demo delivery.</i>
Lighting	Impact	Study leveraged from MA to update lighting measure lives. <i>Plan impact: Decrease in claimable lifetime savings for electric: exterior lighting measure lives decreased from 14 years to 10 years.</i>
Small Business	Impact	Study leveraged from MA to verify savings for refrigeration and HVAC measures through site-specific inspection, metering, and analysis. <i>Plan impact: Decrease in claimable savings for electric non-lighting: realization rates decreased from 130% to 104%.</i>
ConnectedSolutions	Impact	Verify demand reductions from C&I Peak Shaving DR Program <i>Plan Impact: Decrease in claimable summer kW savings: realization rate decreases from 100% to 82%.</i>

Studies Informing 2021 Plan – Residential

Program	Study Type	About
EnergyWise Single Family, Energy Wise Multi-Family, Income Eligible Services Multi-Family	Impact	<p>Verify gross and net energy savings estimates using billing analysis and engineering approaches for measures installed through the retrofit programs.</p> <p>Plan impact: <i>Decrease in overall claimable savings for electric and gas</i></p> <p><i>EWSF: ~20% decrease in electric/~20% decrease in gas savings</i> <i>EWMF: ~12% decrease in electric / ~31% decrease in gas savings</i> <i>IEMF: ~5% increase in electric / ~5% decrease in gas savings</i></p>
	Process	<p>Assess effectiveness of overall program delivery and satisfaction</p> <p>Plan impact: <i>No savings impact. Will inform program delivery</i></p>
Behavior/ Home Energy Reports	Impact	<p>Verify energy savings estimates from Home Energy Reports.</p> <p>Plan impact: <i>Increase in claimable electric savings / decrease for gas</i></p> <ul style="list-style-type: none"> - <i>88% to 98% increase in electric realization rate</i> - <i>108% to 84% decrease in gas realization rate</i>

Studies Informing 2021 Plan – Residential

Program	Study Type	About
ENERGY STAR Lighting	Market	<p>Shelf Stocking Analysis: Assess trends in availability and shelf prices of light bulb in program stores</p> <p>Sales Data Analysis: Assess sales data to characterize the current lighting market and track market share over time. (Coordinated with MA, CT and NH)</p> <p>Plan impact: <i>No savings impact. Will inform program delivery</i></p>
	Impact	<p>Study leveraged from MA that updated hours of use, delta watts and freeridership values for efficient lighting.</p> <p>Plan impact: <i>Decrease in claimable electric savings ~30% decrease in electric savings</i></p>
ENERGY STAR HVAC ENERGY STAR Products Income-eligible Single Family New Construction	Impact	<p>Study leveraged from MA that reviewed TRM savings and measure life assumptions for selected HVAC and appliances.</p> <p>Plan impact: <i>TBD.</i></p>

Studies Informing 2021 Plan – Residential

Program	Study Type	About
ConnectedSolutions	Impact	Study leveraged from MA that verified demand reductions from Wifi Direct Load Control program Plan impact: Increase in claimable summer kW savings (<i>from 0.55kW to 0.59kW</i>)
	Impact	Study leveraged from MA that verified demand reductions from Residential Energy Storage Demonstration Plan impact: No change in claimable summer kW savings

Studies Informing 2021 Plan – Cross-Cutting

Study	Type	About
Piggybacking	Custom	Assess best practices for leveraging MA-based studies in Rhode Island <i>Plan impact: No savings impact. Will inform EM&V planning</i>
Legislated M&V	Impact	Verify claimed energy savings from the Company's energy efficiency programs and review of Company's evaluation process <i>Plan impact: No savings impact. TBD</i>
HVAC – Air Source Heat Pumps	Market	Assess current status of the heat pump market and potential for future growth of heat pumps <i>Plan impact: No savings impact. TBD</i>